

# 氮化鎵發光二極體之氧化製程研究

學生：陳威佑

指導教授：王興宗 教授

國立交通大學 光電工程研究所

## 摘要

本論文主要研究主題為探討光致氧化在氮化鎵及氮化鋁上之氧化情形及光致氧化在氮化鎵發光二極體發光強度引響。

在氮化鎵上之氧化探討中，我們發現氧化速率會隨著施加偏壓而上升，而氧化膜厚度和氧化時間成線性關係；而在紫外光強度上，我們發現在高紫外光強度下氧化速率會成飽和現象；另外我們也發現氧化膜和氮化鎵形成的介面會隨著氧化時間而變為較為不平整。而我們在氮化鎵和氮化鋁上的異質結構中也觀察到氮化鎵和氮化鋁具有高氧化選擇比。

而在光致氧化在氮化鎵發光二極體發光強度引響之探討中，我們使用光致氧化方法來進行 LED 發光區域的表面粗化處理，並討論在 LED 元件之製作流程及光致氧化對於元件特性之引響，而對於完成後之 LED 元件經過 I-V 和 L-I 量測以後，經過光致氧化在偏壓 15V 下經過 30 分鐘和 45 分鐘氧化處理過之 LED 元件在 20 mA 的超作電流下其發光強度分別增加 16%和 36 %

# Study of Oxidation Process of GaN Light Emitting Diode

Student : Wei-you Chen

Advisor: Prof. Shing-Chung Wang

Institute of Electro-Optical Engineering

National Chiao Tung University

## Abstrate

There are two subjects in this thesis. First, we study the Photoelectrochemical (PEC) oxidation on GaN and AlN. Second, we study the influence of PEC oxidation on GaN LED.

First, the oxidation rate is increase with the applied bias. In the relation between oxidation rate and UV light intensity, the oxidation rate is saturated at high UV light intensity. The correlation between oxide thickness and oxidation time is linear; the interface roughness between oxide film and GaN also increase with the oxidation time. In the GaN/AlN heterostructure, the experimental results showed a good oxidation selectivity between GaN and AlN.

At the second part of the thesis, PEC oxidation are used to increase the surface roughness of GaN LED emission area. First, the fabrication of oxidized GaN LED and the influence of PEC oxidation on GaN LED process was discussed. Then the current-voltage (I-V) and light output intensity-current (L-I) characteristics of LEDs was performed. After LEDs were oxidized for 30 min and 45min at applied bias of 15 V, the light output intensity was enhanced about 16% and 37 % respectively at the driving current of 20mA.